# Information with regards to the mini-dissertation

<table>
<thead>
<tr>
<th><strong>Project Title</strong></th>
<th>Warehouse Improvement and Facilities Design for a Manufacturer and Distributor of Food Products</th>
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<td>17/10/2012</td>
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## Abstract

African Dynamics is in the process of consolidating the Gauteng regional operations of the five facilities located in Gateway Industrial Park, Centurion, into a single facility in Sunderland Ridge, Centurion. The five existing facilities at Gateway Industrial Park have critical capacity issues and are experiencing numerous inefficiencies. African Dynamics needs to address these problems by consolidating operations of the five facilities into a single facility.

The solution will be realised by analysing the current operations and subsequently evaluating the current operational requirements and constraints. Data will be gathered and manipulated. Based on these results, future operational requirements will be projected. In-depth research on best practices will performed, which will lead to the generation of alternate plans. The alternatives will be evaluated (with input from the company) and the best proposal will be selected: The final design will be handed to African Dynamics for implementation.

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## Category

Facilities Planning

## Declaration

1. I understand what plagiarism is and I am aware of the University's policy in this regard.
2. I declare that this is my own original work
3. Where other people's work has been used (either from a printed source, internet or any other source) this has been carefully acknowledged and referenced in accordance with departmental requirements
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Signature
Final Report

Warehouse Improvement and Facilities Design for a Manufacturer and Distributor of Food Products

Author: M.N. Hatton

29051755

Study Leader: Prof. C. van Schoor

17 October 2012
Executive Summary

African Dynamics is dedicated to providing the best quality food products to customers with varying requirements. The company’s goal is to build a world class business with a leading position in South Africa, by providing products and services that are appropriate and effective. African Dynamics provides for its customers through two core operations, namely manufactured and wholesale products.

There are five existing facilities at Gateway Industrial Park, in Centurion. All of these facilities have critical capacity constraints and are experiencing numerous inefficiencies, namely i) duplication of receiving, staging and consolidation areas; ii) inventory management problems such as the inability to quickly and effectively locate stock and perform stock takes; iii) duplication of material handling equipment; and iv) a general lack of coordination. Security and control are also of concern to management, due to the fact that any person may gain access to Gateway Industrial Park, thus making it difficult to control the multiple security points.

This document aims at improving warehouse operations and producing a facilities design. The facility layout is aimed at addressing the critical capacity constraints and inefficiencies of the current facilities. This has been accomplished by consolidating inventory and operations into a single new facility, through the complete process of delivering a new full size optimum warehouse design, based on best practices relating to the food manufacturing environment.

In order to effectively achieve this, a comprehensive analysis and evaluation of African Dynamics operations was undertaken. In-depth calculations were performed to determine the future operational requirements of the warehouse. Nine possible alternatives were identified and subsequently reduced to three feasible alternatives, for which three designs were created. Designs were based upon best practices, future operational requirements of African Dynamics and by obtaining input from the key stakeholders in the African Dynamics team.
The most optimal solution was found through the third design, by using a weighted factor method. The core concepts of the third design are:

- The premises layout is based on the centralisation of operations in one area.
- The preferred storage method is a FIFO (First-In-First-Out) racking system.
- Use of current forklifts, i.e. no investment is required for forklifts.
- The raw materials storage and warehouse storage are in a single area.

The results of the project are:

- An in-depth survey of best-practices relating to the food manufacturing and distribution environment. Many of the best practices have been incorporated into the facility design(s) and more are recommended to be implemented into the day-to-day operations of the business so as to increase overall efficiency.
- Quantitative representation of the storage space required, based on the different storage methods proposed.
- Reduction in the total storage space required (see Figure 20).
- A warehouse that has multiple picking bays, allowing for optimal control of out-going stock.
- An efficient plant and warehouse layout that allows for effective stock-taking, minimises the chance of theft and has no unnecessary duplication of receiving or shipping areas.
- An integrated final design that allows for expansion and flexibility.

African Dynamics’ facilities were at critical capacity at the beginning of the year in a combined warehouse space of 4420m². Taking into consideration the company’s rapid growth of 35% per year, the required space will only be 5174 m² by February 2017. However, the available storage space for the facility is only 4450 m², which is 700 m² less than the required storage space for Phase 1.

The company will either have to increase the size of phase 1, or begin to build Phase 2 earlier. African Dynamics should implement the best-practices into their day-to-day business. The project, along with the designs, has been successfully handed over to African Dynamics. African Dynamics may decide to consult with the student.
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Chapter 1: Project Plan

1.1. Background

1.2. Company Background

African Dynamics is dedicated to providing the best quality food products to customers with varying requirements. The company’s goal is to build a world class business with a leading position in South Africa, by providing products and services that are appropriate and effective. With the company’s 16 years of unique experience and understanding of the African market, the company is able to provide culturally acceptable food products that are nutritious, cost effective and convenient. (African-Dynamics).

African Dynamics provides for its customers through two core operations:

1. The company orders raw materials, manufactures products from these raw materials, packages the products and then finally warehouses these products; known as manufactured products. The company manufactures soya mince, milk powder blends, various dry powder blends, drinks and instant porridges; to name a few.

2. The company purchases products in bulk and warehouses these products for distribution at a later stage; known as wholesale products. Examples of wholesale products include maize, samp, beans, split peas, sugar, salt, sardines, tomato sauce, oil, fruit and vegetables.

Figure 1: African Dynamics’s core operations.
African Dynamics provides food for its customers via one of two methods of agreement: tender manufacturing or contract manufacturing. Tender manufacturing is predominantly government related (schools feeding), whereas contract manufacturing is mostly for large retailers. (African-Dynamics).

Figure 2: African Dynamics employees performing various tasks.

The company has two regional branches. The main regional branch is situated in Centurion, Gauteng; currently providing food products for Limpopo, Mpumalanga and Gauteng. The second branch is situated in East London; currently providing food products for the Eastern Cape only.

1.2.1. Background to the Problem
African Dynamics currently has five facilities situated on stands in close proximity to one another (three are on adjacent stands) in Gateway Industrial Park, Centurion, Pretoria. The company is considering consolidating the operations of the five facilities into a single new facility in Sunderland Ridge, Centurion. The aim is to increase capacity and efficiency. The five facilities currently provide for:

- Storage of raw materials
- Production areas for the manufacturing of goods
- Warehousing of manufactured goods
- Warehousing of wholesale products

The company is also planning to decentralise its national operations by moving Limpopo (L) warehousing operations to Groblersdal, Limpopo. The aim is to lower the demand at the main regional branch in Gateway Industrial Park (due to capacity constraints) and to improve customer service and efficiencies to the L customer base, mainly through reduced transportation costs and delivery lead-time. It is planned that an existing facility be leased near Groblersdal by June 2012. All manufacturing operations will be maintained at Gateway Industrial Park, while the manufactured Limpopo and Mpumalanga goods will be transported to the Groblersdal warehouse. Wholesale products will be sent directly to Groblersdal for final distribution. The planned Groblersdal warehouse has a capacity of 800m².
1.3. **Problem Statement**

The five existing facilities at Gateway Industrial Park, Centurion have critical capacity constraints and are experiencing numerous inefficiencies. *Figure 3* graphically represents the critical nature of the current situation. Duplication of receiving, staging and consolidation areas; inventory management problems such as the inability to quickly and effectively locate stock and perform stock takes; duplication of material handling equipment; and a general lack of coordination are, to name, a few of the inefficiencies. Security and control are of concern due to the fact that any person may gain access to Gateway Industrial Park, thus making it difficult to control the multiple security points. The company is experiencing the many disadvantages of a decentralised warehouse, whilst reaping few benefits from having its operations divided.

*Figure 3: Total space allocation of the current five facilities.*
African Dynamics currently has a total usable space (see Table 1) of 4 300 m², spread across the five facilities for the storage of raw materials, production areas, and warehousing of manufactured and wholesale goods. The effect of decentralising the warehousing operations of Limpopo (to the leased facility in Groblersdal, Limpopo) on Gauteng’s facility’s capacity needs to be determined.

Table 1: Usable space for the five facilities; for the storage of raw materials, manufacturing of products and storage of products.

<table>
<thead>
<tr>
<th>Description</th>
<th>Total Manufacturing/ Storage Space Available (m²)</th>
<th>% Usable Space</th>
<th>Usable Manufacturing/ Storage Space (m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facility 1: Raw Materials</td>
<td>500</td>
<td>50</td>
<td>250</td>
</tr>
<tr>
<td>Facility 2: Production</td>
<td>450</td>
<td>50</td>
<td>225</td>
</tr>
<tr>
<td>Facility 3: Warehousing</td>
<td>2 000</td>
<td>75</td>
<td>1 500</td>
</tr>
<tr>
<td>Facility 4: Warehousing</td>
<td>2 100</td>
<td>75</td>
<td>1 575</td>
</tr>
<tr>
<td>Facility 5: Warehousing</td>
<td>1 000</td>
<td>75</td>
<td>750</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>6 050</strong></td>
<td></td>
<td><strong>4 300</strong></td>
</tr>
</tbody>
</table>

Note: Usable space refers to the area (estimated by the company) that can be effectively used to store raw materials, manufacture products and/or store products. For example, aisle space is classified unusable. See the table above for the calculation of the total usable space.

African Dynamics has a long-term goal of achieving a turnover of R1 billion by February 2017, projecting a required 39 % growth rate per year for the next five years (including inflation), from current turnover of R 226 million as at financial year end 29 February 2012 (refer to Table 2). With the forecasted increase in turnover, a growth in product volumes will occur. The company will have to meet this demand by constructing a new facility in Sunderland Ridge, Centurion; with the capacity to handle the projected demand. The initial plan from African Dynamics is to construct a warehouse of capacity 7 500m² in total; 750 m² for offices, 500 m² for raw material storage, 1 000 m² for production and the remaining 5 250 m² for warehousing of manufactured and wholesale goods. The initial plan amounts to a capacity of 5 063m² usable space for (refer to Table 3); the storage of raw materials, production of goods, and warehousing of manufactured and wholesale goods (excluding the needs of Limpopo warehousing operations). The new facility must have optimum storage, flexibility, distribution interfaces, and improved security and control measures.
There is potential for costs to be greatly reduced in a single, consolidated system because there are economies of scale in a smaller number of facilities. (Institute-for-Working-Forces).

**Table 2: Actual and projected turnover and product volumes for the respective financial years.**

<table>
<thead>
<tr>
<th></th>
<th>Gauteng</th>
<th>Limpopo &amp; Mpumalanga</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turnover (million Rands)</td>
<td>134</td>
<td>60</td>
<td>194</td>
</tr>
<tr>
<td>Product Volume (Tons)</td>
<td>17 285</td>
<td>8 590</td>
<td>25 875</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Gauteng</th>
<th>Limpopo &amp; Mpumalanga</th>
<th>Total</th>
<th>% Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turnover (million Rands)</td>
<td>222</td>
<td>128</td>
<td>350</td>
<td>80.41</td>
</tr>
<tr>
<td>Product Volume (Tons)</td>
<td>21 727</td>
<td>17 314</td>
<td>39 041</td>
<td>50.88</td>
</tr>
</tbody>
</table>

**Note:** The Limpopo andMpumalanga operations are specified separately from the Gauteng operations, even though Gauteng currently accounts for all the manufacturing, warehousing and distribution. This is prepared with the foresight to allow for analysis and forecasting of the decentralisation of the Limpopo and Mpumalanga operations.

**Table 3: Proposed space requirements for the new facility.**

<table>
<thead>
<tr>
<th></th>
<th>Estimated Total Space Required</th>
<th>% Usable Manufacturing/Storage Space</th>
<th>Estimated Usable Manufacturing/Storage Space</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office</td>
<td>750</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Raw Material</td>
<td>500</td>
<td>75</td>
<td>375</td>
</tr>
<tr>
<td>Production</td>
<td>1 000</td>
<td>75</td>
<td>750</td>
</tr>
<tr>
<td>Warehousing</td>
<td>5 250</td>
<td>75</td>
<td>3 938</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>7 500</strong></td>
<td><strong>5 063</strong></td>
<td><strong>5 063</strong></td>
</tr>
</tbody>
</table>
1.4. **Project Scope**

1.4.1. **Project Aim**

The aim of this project is to develop a facilities plan for a single consolidated plant and warehouse.

However to achieve this, an in depth analysis and evaluation of African Dynamics operations is required.

The facility layout is aimed to address the critical capacity constraints and inefficiencies of the current facilities by consolidating inventory and operations into a single new facility, through the complete process of delivering a new full size optimum warehouse design based on best practises relating to the food manufacturing environment.

The initial capacity plan for the proposed facility will be reviewed as part of the project, taking into account reduction of inefficiencies and the exclusion of the Limpopo and Mpumalanga warehousing operations.

The option of expending costs for the investment into the single new facility will be compared against the option of leasing multiple warehouses.

1.4.2. **Project Approach**

The solution will be realised by following the Strategic Facilities Plan for manufacturing facilities and then adapting it into three distinct phases, each phase having its own activities (depicted in *Figure 4*). Each activity has its own tasks (as can be seen on the following page). Deliverables have been set for each project phase. Each of the three phases will be discussed on the subsequent pages.

*Figure 4: The three project phases with their related activities.*

- **"As-Is" Analysis**
  - Analyse current operations
  - Evaluate current operational requirements and constraints

- **"To-Be" Requirements**
  - Project the future operational requirements
  - Survey of best practices

- **Solution Design**
  - Generate alternate plans
  - Evaluate the various options and make recommendations
  - Project finalisation and sign-off
Phase 1. “As-Is” Analysis

1.1) Analyse the operations, by investigating the following:
- Receiving stations,
- Docking stations,
- Warehousing,
- Management of inventory,
- Material handling equipment – including mixers, FFS (form, fill & seal) machinery, packaging machinery, forklifts and cranes,
- Product types and product mixes
- Product volumes: manufactured, wholesale and storage,
- Storage policies,
- Purchasing policies,
- Stock policy (i.e. safety stock),
- Picking process,
- Business processes,
- Pallet handling and storage,
- New unit load formation,
- Packaging facilities,
- Accuracy of dispatching,
- Inbound transportation, and
- Outbound transportation.

1.2) Evaluate current operational requirements and constraints, based on the operations as per “Step 1.1’’. The following will be focused on:
- Limitations,
- Problems,
- Challenges, and
- Cost-drivers.

Deliverables for Phase 1

I. Material handling methods documented.
II. Current operational requirements documented.
III. Current operational constraints documented.
Phase 2. “To-Be” Requirements:

2.1) Survey of best practices:
- Visit similar facilities,
- Talk to experts and gather information,
- Conduct research – books, journals, web sites, UP Library site, and
- Write a literature review based on the findings.

2.2) Projection of the future operational requirements:
- Validate forecast demand,
- Develop specifications for the new facility based on current operations (and their inefficiencies) and the forecast demand, in terms of:
  - Flexibility,
  - Control,
  - m² storage,
  - Peak times,
  - Design requirements: volume, value and size,
- Compare specifications against the initial plan by African Dynamics.

Deliverables for Phase 2

I. Given forecast data validated.
II. Future operational requirements projected.
III. Industry best practices summarised.
Phase 3. Solution Design:

3.1) **Generate alternate plans:**
- Facilities plan considering relocating to a single warehouse,
- Specify storage requirements,
- Specify material equipment requirements, and
- Specify facility service requirements.

3.2) **Evaluate the various options and recommend the best suited option:**
- Consider the supply chain effects on all facility operations,
- Do financial/feasibility analysis (costing, impact, capital investment),
- Consider payback options,
- Design the optimal layout on Computer Aided Design (CAD) software – Trimble Sketch Up,
- Obtain input from the company, and
- Recommend the best-suited option.

3.3) **Project finalisation and sign-off:**
- Consult with African Dynamics on the report findings,
- Present the final report, and
- Hand-over the design to African Dynamics.

**Deliverables for Phase 3**

I. Alternate plans documented.
II. Final design documented.
III. Final design presentation.
IV. Final design poster created.
V. Final design handed over to African Dynamics.
VI. Final design handed over to African Dynamics’s selected architect.
1.4.3. Excluded from the Project Scope

- Implementation of the facility design.
- African Dynamics has a second branch in the Eastern Cape. This will not be covered in the project.
- Alternatives for the location of new the facility will not be analysed. The company has already found a new site in Sunderland Ridge, Centurion; for which the facility can be built at.
- If/when the company reaches capacity for the new facility (approximately the year 2017), the company will have to extend to the facility. Space is available on the planned site, but such expansion will not be covered in the project scope, i.e phase 2. However, consideration needs to be given to phase 2 when designing phase 1.

1.4.4. Project Assumptions

- The Limpopo warehousing operations will be moved to Groblersdal, Limpopo.
- This project will be completed before construction of the new facility commences.

1.4.5. Mentorship

- The African Dynamics team, overseen by Mr Cobus Steyl and Mr Chris Boylan, will provide guidance.
- The project leader is Prof. Chris van Schoor.

1.4.6. Project Resources

The research student is the primary resource. However the most critical resource is the limited time available for the completion of the project. Various experts in the industry will be consulted so that the student may gain knowledge and see first-hand how facilities of this nature operate. The project mentor and project leader will assist in the project process by sharing their knowledge and insight. The Computer Automated Design (CAD) software – Trimble Sketch Up - will be an important tool to develop facility layout plans.
Chapter 2: Analysis of the Current Operations and Challenges

2.1. Analysis of the Current Operations

2.1.1. Overview of the Current Operations for Each of the Five Facilities

The location of the five facilities (buildings) occupied by African Dynamics are depicted in Figure 5:

- The first facility provides storage for raw materials used in production. The production takes place in the second facility. The first and second facilities share the same property.
- The third facility is on a property adjacent to the property of the first and second facilities. The majority of the facility provides for the storage of wholesale products. The remainder provides for the storage of raw materials, due to excess raw materials because of the first facility being at full capacity.
- The fourth facility provides warehousing only.
- The fifth facility provides for storage of packaging materials, and the manufacturing of a few products.
- The main offices of the company are situated at the second and third facility. There are a few offices at the other three facilities.

Figure 5: Aerial map of the current five facilities
2.1.2. Production Area

The company produces batches of products. Multiple fill lines are used and are subject to slight variation depending on the product being produced. It is therefore best to analyse the production area (second Facility) by dividing it into 3 areas:

1) Air controlled room; this is where the powdered jellies are produced,
2) Elevated mezzanine, from which raw materials are loaded into the nauta mixer and ribbon mixer. Underneath the slab, the mixed product comes out from the mixers and is packaged.
3) Open area for the remaining production.

Table 4: Space requirements for the current production area.

<table>
<thead>
<tr>
<th>Air controlled room</th>
<th>Equipment</th>
<th>Quantity</th>
<th>Space Required (m²)</th>
<th>Total Space Required (m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ribbon blender</td>
<td>1</td>
<td>32</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>Conveyor</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Jar filler</td>
<td>1</td>
<td>15</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Conveyor (for expiry date printing)</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Forklift space</td>
<td>1</td>
<td>12</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Space requirement for air controlled room</td>
<td></td>
<td>63</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Elevated slab</th>
<th>Equipment</th>
<th>Quantity</th>
<th>Space Required (m²)</th>
<th>Total Space Required (m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Form, fill and seal</td>
<td>2</td>
<td>9</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>Auger filler</td>
<td>1</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Ribbon blender</td>
<td>1</td>
<td>32</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>Nauta mixer</td>
<td>2</td>
<td>8</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>Metal detector</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Band sealer</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Stitching machine</td>
<td>1</td>
<td>9</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Pallet jack space</td>
<td></td>
<td></td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Loading Area</td>
<td></td>
<td></td>
<td>8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Space requirement for elevated slab</td>
<td></td>
<td>121</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Open area</th>
<th>Equipment</th>
<th>Quantity</th>
<th>Space Required (m²)</th>
<th>Total Space Required (m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Form, fill and seal</td>
<td>1</td>
<td>9</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Conveyor</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Metal detector</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Fully automatic Box machine</td>
<td>1</td>
<td>25</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Conveyor (for expiry date printing)</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Forklift</td>
<td>1</td>
<td>50</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Space requirement for open area</td>
<td></td>
<td>91</td>
<td></td>
</tr>
<tr>
<td></td>
<td>General Temporary Storage Area</td>
<td></td>
<td>120</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total space requirements</td>
<td></td>
<td>395</td>
<td></td>
</tr>
</tbody>
</table>

Note: the slab in the production area serves as a means of enabling the workers to get high enough to load the mixers. The workers stand on the slab and load the raw materials.
As seen in Table 4, the space requirements for the production equipment total 395 m². Space is also required for the forklifts to easily manoeuvre and for temporary storage area of raw materials and finished goods.

2.1.3. Product Flow within Production Area.
All the raw materials enter the system and are placed in temporary storage. For each of the main products produced, the product flow is represented. All the products are currently produced at the second facility, except the jelly and soya mince which are produced at the fifth facility.

Figure 6: Product Flow within Production Area
2.1.4. Transportation

Inbound Transportation

The majority of the inbound goods are received via 34 ton link trucks. The links have a length of 36 metres. The inbound transportation is provided by suppliers. The suppliers either deliver at the warehouse with their own trucks or they engage with third party companies to deliver the goods at the warehouse.

The majority of the trucks arrive overnight and in the morning there is a maximum queue of 12 trucks. Two trucks can be accommodated simultaneously by the receiving area for unloading.

Outbound Transportation

The majority of the outbound products are transported by 8 ton trucks (11.5 metres in length). 24 ton tri-axel trucks (24 metres in length) and 34 ton trucks (36 metres in length) are also used for outbound transportation. African Dynamics is responsible for the outbound transportation, contracting third party companies to deliver goods to its customers. 90% of the outbound trucks are 8 ton trucks, with the remaining being 34 ton and 24 ton trucks.

Three trucks can be loaded simultaneously.

Standard Truck Sizes

The following table indicates the length, width and turning circle of the trucks.

Table 5: Truck sizes summary

<table>
<thead>
<tr>
<th>Truck Type</th>
<th>Length (m)</th>
<th>Width (m)</th>
<th>Turning Circle (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>34 tonner</td>
<td>36</td>
<td>2.5</td>
<td>40</td>
</tr>
<tr>
<td>24 tonner</td>
<td>24</td>
<td>2.5</td>
<td>25</td>
</tr>
<tr>
<td>10 tonner</td>
<td>11.5</td>
<td>2.5</td>
<td>13</td>
</tr>
</tbody>
</table>
2.1.5. Receiving and Shipping Functions
African Dynamics currently uses all docking areas in their facilities for both receiving and shipping; i.e. no areas are designated exclusively for receiving or for shipping operations. The first and second facility share a single area for both the receiving and shipping operations. The third facility has three areas for receiving and shipping. The fourth facility has a single area for receiving and shipping. The fifth facility has a single area for receiving and shipping.

2.1.6. Product Cycle
The company manufactures and distributes products on a tender basis (school feeding) or contract basis (company). School feeding takes preference and follows a monthly cycle with:

- Stock take: first 3-4 days,
- Receiving of goods and manufacturing: 2 ½ weeks,
- Loading of goods for distribution: last week.

These stages overlap and may vary according to the number of days in a month. Public holidays also have an effect on the monthly cycle. Stock take is taken as early in the month as possible, but can be delayed due weekends and public holidays.

Contract manufacturing does not follow a cycle. The company provides a guarantee of a maximum lead time of 14 days for products to be delivered to the customers. Depending on the available stock (including buffer stock) and the capacity of production, contract manufacturing is scheduled.

2.1.7. Product Types and Product Mixes
African Dynamics provides for its customers through two core operations:

- Manufactured products: The company orders raw materials, manufactures products from these raw materials, packages the products and then finally warehouses these products; known as manufactured products. The company manufactures:
  - soya mince,
  - milk powder blends,
  - various dry powder blends, and
  - drinks and instant porridges,
- **Wholesale products:** The company purchases products in bulk and warehouses these products for distribution at a later stage; known as wholesale products, such as:
  - maize,
  - samp,
  - beans,
  - split peas,
  - sugar,
  - salt,
  - sardines,
  - tomato sauce,
  - oil,
  - fruit, and
  - vegetables

All contract products are manufactured, i.e. none of the contract products are wholesale products. The quantity and type of products manufactured for contracts change constantly. This is due to the customers and African Dynamics signing short term contracts according to demand. For example, a supplier will request a once-off order for 300 000 boxes of coffee creamer. African Dynamics will have to produce these products in the space of two weeks (specified maximum lead time for customers). The products will then not necessarily be produced again. Another contract order will be placed and the company will then have to start producing a different product.

Tender products used to feed school children are both manufactured and wholesale, but are predominantly wholesale. The type and quantity of products manufactured for school feeding can remain unchanged for long periods of time, due to the nature of tenders. The wholesale products make up eighty per cent of the tender products with manufactured making up the remaining.

African Dynamics’s products are characterised as high volume and low cost.

### 2.1.8. Packaging

The manufactured products are packaged in bags and boxes, depending on the need of the customer. The wholesale products have the same unit load size for receiving and shipping. The bags used for packaging are 25kg, 12.5kg, 10kg, 5kg and 2kg. The 1kg, 0.75kg and 0.5 kg bags are packed into boxes.
2.1.9. **Storage policy**

Manufactured and wholesale goods are stored on pallets. A maximum of 1 ton of goods is packed per pallet. However, for example, only 300kg of fruit and vegetables are packed on a pallet. Due to the nature of the products (low value), wooden pallets are used for storage. Some pallets can be stacked four high. The pallets are 1 metre by 1,2 metres in dimension.

2.1.10. **Stock Policy**

The ordering of wholesale goods from suppliers can be accurately forecasted. It is based upon the following: Menus are set up for primary school and high school children. The menu states that each child needs a certain amount of each type of food per day. The number of children that need to be fed per day is calculated. The number of feeding days for the month is calculated. Every month, this is used to calculate the quantity of each product needed to be ordered from suppliers. The quantities of stock ordered will be the amount calculated, less stock left over the previous month. The quantities ordered are then rounded up to the closest number of full truckloads. As a general rule, the company's policy is to minimise buffer stock as it has an influence on cash flow and is seen as a negative impact.

Therefore, no or very limited wholesale buffer stock is kept. It is assumed that safety stock will have too small an effect on the warehouse storage operations, and therefore should not be considered.

2.1.11. **Material Handling Equipment**

The company currently only uses forklifts and pallet jacks for material handling in the warehouse.

Four diesel-powered forklifts are currently used to transport goods within and between the warehouses. Two gas-powered forklifts are used in the production area as they do not emit fumes. These forklifts have varying lifting capacity of two and three tons.

Five pallet jacks are used in the production and warehouse departments, each with a lifting capacity of one ton.
2.1.12. Product Flow between the Facilities
Goods either enter the system at the raw material facility (Facility 1) or at one of the three warehouses (Facility 3, 4 and 5). From the first facility, goods enter the temporary storage area in the second facility. Raw materials are manufactured and then sent to a warehouse (Facility 3, 4 and 5). Most of the manufactured products are stored in the third facility. Fruit and vegetables are always stored in Facility 4. When it comes to the shipping function, the required products from each warehouse are picked and the loaded onto trucks.

2.1.13. Picking Process
During peak periods, products are pallet picked for a maximum of twenty-five 8-ton trucks, six 24-ton trucks and three 34-ton trucks. Ninety per cent of shipments are picked loose (products loaded from pallets onto trucks, pallets don't go with the shipment) and the remaining 10 % of the pallets go with the shipment. This is dependent on whether the customer will return the pallets or not.
2.2. **Evaluation of Current Operational Requirements and Constraints**

African Dynamics is experiencing many problems and inefficiencies, such as:

1) duplication of receiving, staging and consolidation areas,
2) duplication of material handling equipment. Many forklifts are currently needed due to the splitting of warehouses, as the distances travelled are now extremely lengthy,
3) damages to stock and equipment, due to the forklift drivers cause having to work at such a fast pace to make up for the lengthy distances that they have to travel,
4) inventory management problems such as the inability to quickly and effectively locate stock and perform stock takes,
5) theft of stock due to the goods being divided over five facilities. It is tremendously hard to keep control of stock,
6) Unnecessary loading and unloading of trucks - some trucks have to be loaded just to move goods between facilities (particularly from the 1st, 2nd or 3rd to the 4th or 5th). This is a waste of labour and incurs tremendous costs,
7) security and control are of concern - any person may gain access to the facilities through any of the 8 gates (spread amongst the five facilities). It is impossible to control that many access points.

Overall, operating expenses are much higher than they could be with an effective solution of a new facility to meet African Dynamics needs.
Chapter 3: Best Practice Warehouse Operations

3.1. Introduction

Operating expenses are a major concern for today’s supply chain managers, pushing them to improve their warehouse operations by increasing agility, visibility and labour efficiency. (Aberdeen-Group, 2009).

To get the most out of the operation, a number of best practices can be adopted to reduce expenses, improve productivity and improve overall customer satisfaction. Best practices vary from industry to industry. A number of best practices can be applied to companies from different industries. However, some best practices can only be applied to certain industries. (Murray, Warehouse Best Practices)

Best-practises need to be implemented by incorporating the trade-off of the needs and potential benefits for the company against the costs and practicality associated with the best-practices.

This literature study aims to shed light on best-practices that should be considered in both the design and operations of African Dynamics’s new facility. The study is summarised and synthesised from information obtained from various sources.

The literature study covers everything from the receiving function through to the shipping function (represented in Figure 7); and the safety, control and overall condition of the facility. The best-practices are shown in italic.

Best practices in medium to high levels of automation were not focussed up on, as they are not likely to benefit African Dynamics.

![Figure 7: Various functions of a warehousing operation.](http://factory.isye.gatech.edu/publications/presentations/2003/clm/Mnais_BestBreedWIPerformance_CLM_Presention_Iup.pdf)
3.2. Material Handling Procedure

Many people see material handling synonymous to material handling equipment. However, this view is a very narrow perspective. The focus should rather be on:

- 1st - on the material,
- 2nd - on the move, and
- 3rd - on the method.

It is quite easy to encounter a problem situation and immediately think of solutions rather than material handling system solutions. Equipment specification is one of the last steps in the process of determining the preferred material handling system.” (Tomkins, 2010).

3.3. Receiving and Inspecting

A best practice is to inspect shipments immediately. It is much easier to fix a problem at the front end than having it float downstream. (Del Franco, Operations & Fulfilment: Incoming Traffic, 2007).

Another best method is to create a trouble zone. An area on the receiving dock should be dedicated for problematic goods. If something on the truck is completely unexpected, it can be placed on the dedicated area and the problem be sorted out thereafter. (Del Franco, Operations & Fulfilment: Incoming Traffic, 2007).

3.4. Unloading

When an order can be fulfilled by inbound inventory, the inventory should be flagged as cross-dock eligible. Cross docking involves pre-allocation of the inventory prior to receiving it. When the inventory is received, it is immediately moved to the shipping dock to be matched up with the rest of the order. In most cross-dock scenarios, the put-away, replenishment and picking steps are greatly reduced or eliminated, allowing quicker fulfilment and higher productivities. (Exceed, Back-to-Basics: Part 1 Receiving, 2006).
One sure way to improve receiving accuracy and productivity is to implement **Advanced Shipping Notices** (ASNs). ASNs contain all shipment information at a line level as the product is shipped from the supplier. Typically, all inventory is barcoded at pallet and/or case level. Each line item in an ASN contains the barcode along with the quantity and all inventory specific characteristics. Examples of these characteristics include case pack, configuration, item class, and expiration date. (Exceed, Back-to-Basics: Part 1 Receiving, 2006)

ASNs also allow for future workload planning. If a business doesn't have a system which can import ASNs, there are still advantages to requesting the same information via email, spreadsheet or fax. By manually entering ASN-type information into the system, a company can gain the same benefits of workload planning and receiving efficiencies. (Exceed, Back-to-Basics: Part 1 Receiving, 2006).

### 3.5. Put-Away

Best-practice companies identify products using some form of barcoded or RFID label. Product identification labels, zone or location labels and pallet license plates should all be utilized in the put-away process. Both barcoding and **RFID** (Radio Frequency Identification) can work equally as well to identify product, with barcode labels far more common in today's warehouses. However, the advantage of RFID is that it works better in harsh environments, it has a fast read from almost any position, and the tag can hold a lot of information that can be changed as the product flows through the warehouse. Barcode labels, however, have been used for years, successfully, to identify and manage the flow of materials in the warehouse. (Vitasek, Operations & Fulfilment: Best Practices in Material Handling and Put-away, 2007)

If the option of cross-docking has been exhausted, one should **locate directly to the picking location**: Active picking locations are the best place to direct new inventory. It needs to be determined if the picking inventory has enough inventory to satisfy the future days of picking. (Exceed, Back-to-Basics: Part 1 Receiving, 2006).

**Locate near eventual pick locations**: If it does not make sense to move products to the active pick location, then making the biggest part of the eventual move to the pick location is the next best put-away strategy. It is best accomplished by considering each product separately and analysing the picking profile, picking volume and the speed at which the product is expected to leave the system. (Exceed, Back-to-Basics: Part 1 Receiving, 2006).

**Pick locations based on how often the product is shipped**: When determining how close to get the product to the pick locations, consider shipping volume or haste. A
fast shipping product deserves a reserve location closer to the eventual pick locations because it will replenish more often. In some environments, it may be critical to consider cubic volume instead of units shipped. (Exceed, Back-to-Basics: Part 1 Receiving, 2006).

If the before mentioned best-practices are not possible, put-away directly from receipt to final location is the next best thing to do. Best-practice companies manage the put-away area by calculating resource and space requirements based on expected receipts and current backlogs. (Vitasek, Operations & Fulfilment: Put-Away Best Practices, 2007).

3.6. Storage Function

Create a warehouse within a warehouse: A company can gain tremendous efficiency by grouping together the 20 per cent of its stock keeping units that complete 80 % of its orders (known as the Pareto Principle). This cuts travel time for pickers. Be sure, however, that the 80-20 area or zone is properly designed to accommodate high-volume activity. On the other hand, you may not have the ability to utilize the 80-20 rule, because you may be selling “few of many,” instead of “many of the few!” (Stolarczyk).

Most warehouse operations store and process a wide variety of product types and sizes. To effectively accommodate this variety, it is desirable to provide a variety of storage types and sizes. Trying to utilize only one type of storage media with a variety of products can lead to inefficiencies and low overall cube utilization. (Curtis Barry & Company, 2011).

Operations using fixed picking locations will generally also have a reserve or overflow storage area. The overflow storage area will usually use a system of random storage. A replenishment system will need to be put in place to move product to the fixed locations as inventory levels drop to predetermined levels. (Piasecki, 2001).
3.7. Picking

The average warehouse will have many more shipments than receipts so if you have to choose, concentrate on picking optimization over receiving optimization. (Collins, Best Practices for Picking in Warehouses and Distribution Centers, 2008).

In the distribution centre, walking from one location to the next accounts for 60% of a picker's time. Reducing walking time, then, is all but guaranteed to improve efficiency. That's the rationale for batch picking and wave picking. (Del Franco, Operations & Fulfillment: Batch vs. Wave Picking, 2006).

Picking products is seen as the most labour-intensive and costly activity for almost every warehouse, where the cost of order picking is estimated to be as much as 55% of the total warehouse operating expense. (Murray, Order Picking in the Warehouse).

Warehouse layout is also important in achieving greater efficiencies. Minimizing travel time between picking locations can greatly improve productivity. However, to achieve this increase in efficiency, companies must develop processes to regularly monitor picking travel times and storage locations. (Murray, Warehouse Best Practices).

It is also important to manage the flow of orders in the pick area so that a company can minimise congestion and bottlenecks. (Vitasek, Operations & Fulfilment: On Picking and Packing, 2007).

The most common form of picking documentation is paper-pick-tickets. They may work well for many fulfilment operations, but they are prone to human error and are usually less efficient if you are dealing with high volumes. As such, many companies striving for improved efficiency and accuracy are turning to technology and labelling methods. (Vitasek, Operations & Fulfilment: On Picking and Packing, 2007). Some common methods are:

- **Combined shipping label/pick documents**: These work well in single-order pick environments; when the order is picked, it is immediately placed into its shipping carton and its packing label is applied at the same time. (Vitasek, Operations & Fulfilment: On Picking and Packing, 2007).
- **Hand-held radio-frequency (RF) terminals and portable label printers**: A pick task is sent to the RF device, and the worker goes about the job of picking the product, making the process virtually paperless. (Vitasek, Operations & Fulfilment: On Picking and Packing, 2007).
• **Pick-to-light technology:** This also allows for paperless picking. A system of lights throughout the picking areas is linked to the order management and inventory system. The worker picks products by following the lighted locations and then confirms each pick in the system. (Vitasek, Operations & Fulfilment: On Picking and Packing, 2007).

• **Voice recognition technology:** Voice messages deliver tasks to pickers, who in turn can use common speech to give commands to the system. The system also helps to direct the employee to the pick location. Voice recognition systems are flexible and allow order priorities to be quickly changed. (Vitasek, Operations & Fulfilment: On Picking and Packing, 2007).

Although many companies will not be able to afford some new technologies for picking, a number of best practices can be adopted to improve efficiency and reduce cost. (Murray, Warehouse Best Practices).

**Picker-To-Part:** This particular method is very common and found in most warehouse environments. The process involves a storage area, a picking area and a material handling system that is used to refill the picking locations from the storage area, which can be forklift based or more specialized such as gravity flow racks. The storage area will contain the items required to fulfil the customer orders. The picking operator can then pick the items for each customer order from the items stored in the picking area. As all the items are in a smaller area than the regular warehouse, the picking operator can fulfil the order more efficiently than if they had to pick the items from the general storage area in the warehouse. The gravity flow racks are especially useful for items that are commonly ordered so the picking operator can be in one location and pick items from the trays in front of them. There are a number of technological advances in “picker to part” processes such as “pick to light” or “voice picking”. (Murray, Order Picking in the Warehouse).

**Part-To-Picker:** The part to picker method employs the same physical locations as the previous method; storage area, picking area and a material handling system that moves the items from the storage area to the picking area. The difference with this method is that the picking area is made up of a series of picking bays. The items are moved from the storage area and delivered to the picking bays. Each bay receives the items for one or more orders. The picking operator collects the items delivered to their bay and the customer order is fulfilled in this manner. This method can be subject to wasted labour as picking operators can find themselves waiting for items to be delivered to their picking location. (Murray, Order Picking in the Warehouse).
**Pick To Box:** Pick to box method employs a picking area, a storage area, replenishment of the picking area and a sorter. The picking area is organized so that there are a number of picking zones connected by a conveyor system. The operator fills the box with the items on a customer order and the box moves to the picking zones until the customer order is complete and it is then ready for shipment to the customer. The efficiencies are gained because the operator does not have to consume time collecting individual items, but the cost of the initial set up of this solution could negate any cost benefits that the solution offers. (Murray, Order Picking in the Warehouse).

Picking productivity can be increased and order picker ergonomics improved by *slotting your fastest moving stock keeping units in the waist-to-shoulder area* of your storage media. Another best-practice is *multi-level pick towers*. Multi-level pick towers save travel time and are quite innovative. (Stolarczyk).

Of all warehouse processes, order picking tends to get the most attention. It’s just the nature of distribution and fulfilment that you generally have more outbound transactions than inbound transactions, and the labour associated with the outbound transactions is likely a big piece of the total warehouse labour budget. Another reason for the high level of importance placed on order picking operations is its direct connection to customer satisfaction. The ability to quickly and accurately process customer orders has become an essential part of doing business. (Piasecki, 2001).

Make sure your picking methodology suits your organization. Whether you choose single order, multi-order, batch picking with a single picker, or zone picking, the correct picking methodology is critical for optimizing productivity. (Collins, Best Practices for Picking in Warehouses and Distribution Centers, 2008). The most common picking operations are listed below:

- **Single-order picking:** is the most common picking method. It entails picking to a single order. The entire order is picked and typically placed directly into the shipping container, eliminating downstream handling. In general, orders are prioritized by customer-requested ship date. (Vitasek, Operations & Fulfilment: On Picking and Packing, 2007).

- **Multi-order/batch picking:** Batch picking works best when you have a large number of SKUs that may be ordered and the products are located across a large area. Batching a number of orders together enables a picker to pull the products for a number of orders as he passes by each item’s stocking location. (Vitasek, Operations & Fulfilment: On Picking and Packing, 2007).
• **Wave picking**: A wave is an automated grouping of orders by a specific set of criteria. Orders may be grouped by priority level, by freight carrier, by shipment type, or by destination. These bundled orders are then released to the pick area as a group. (Vitasek, Operations & Fulfilment: On Picking and Packing, 2007).

• **Zone picking**: These orders may be grouped by warehouse zone, such as single-unit pick area, case pick area, or bulk or pallet pick areas. With zone picking an order may be split and subsequently consolidated in the shipping area. (Vitasek, Operations & Fulfilment: On Picking and Packing, 2007).

The methods for order picking vary greatly and the level of difficulty in choosing the best method for your operation will depend on the type of operation you have. The characteristics of the product being handled, total number of transactions, total number of orders, picks per order, quantity per pick, picks per SKU (stock keeping unit), total number of SKUs, value-added processing such as private labelling, and whether you are handling piece pick, case pick, or full-pallet loads are all factors that will affect your decision on a method for order picking. Many times a combination of picking methods is needed to handle diverse product and order characteristics. (Piasecki, 2001).

**Pallet Picking**: Full-pallet picking is also known as *unit-load picking*. The systematic methods for full-pallet picking are much simpler that either piece pick or case pick, however, the choices in storage equipment, storage configurations, and types of lift trucks used are many. The picking methods are described below, relating specifically to pallet picking:

• **Basic pallet picking**: This is the most common method for full-pallet picking. Orders are picked one at a time. The order picker will use some type of lift truck, retrieve the pallet load and stage it in a shipping area in a staging lane designated for that order, or just pick and load directly into an outbound trailer or container. (Piasecki, 2001).

*Table 6: Rationale for selecting picking operation*
*(Taken from: www.inventoryops.com/order_picking.htm)*

<table>
<thead>
<tr>
<th>Total Orders</th>
<th>Picks per Order</th>
<th>Type of Picking Operation To Be Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Moderate to High</td>
<td>Basic Order Picking</td>
</tr>
<tr>
<td>Low to High</td>
<td>Low</td>
<td>Batch Picking</td>
</tr>
<tr>
<td>Moderate to High</td>
<td>Low to Moderate</td>
<td>Zone Picking</td>
</tr>
<tr>
<td>Low to High</td>
<td>Moderate to High</td>
<td>Wave Picking</td>
</tr>
</tbody>
</table>
**Note:** Table 6 provides rationale for deciding upon which picking operations to implement. The total number of orders and the picks per order determine the type of picking operation that should be used.

- **Batch picking:** Since the nature of pallet picking is a single pick per trip, batch picking has no application in pallet-picking operations. (Piasecki, 2001).

- **Zone and wave picking:** Although the normal definition of zone picking where an order is moved from zone to zone as picks are accumulated doesn't apply to pallet picking, pick zones are used in wave picking in pallet-picking operations. The storage area is broken into zones to eliminate multiple lift-truck operators from picking in the same aisle. The lift truck operator may pick the pallet and deliver it directly to the designated staging lane or place it on a unit-load conveyor that will deliver it to the sorting/staging area. (Piasecki, 2001).

- **Task interleaving:** Task interleaving is a method of combining picking and put-away. Warehouse Management Systems (WMS) use logic to direct a lift truck operator to put-away a pallet en route to the next pick. (Piasecki, 2001).

Choosing an order picking system depends on any number of requirements such as cost, complexity, number of customer orders, size and number of items, etc. Every company has a unique requirement and one order picking solution may suit one business and not another. Determining the requirements will ensure that the most efficient order picking solution is selected. (Murray, Order Picking in the Warehouse).

**Pallet-picking equipment** is described as followed:

- **Pallet rack:** There are numerous pallet rack configurations used in full pallet operations, from standard back-to-back single pallet depth configurations to double-deep rack, push-back rack, drive-in/drive-thru rack, and flow rack. The best racking configuration for your operation will be based on the total number of pallets per SKU (Stock Keeping Unit), pallets per pick, and the length of time the product is in the rack prior to shipment. There are a lot of trade-offs in choosing a racking configuration including storage density, picking productivity, equipment costs, and the ability to maintain first-in first-out. (Piasecki, 2001).

- **Automated conveyor and sortation systems:** Automated conveyor and sortation systems can be combined with ASRS (Automated Storage and Retrieval System) units or used in conjunction with manual picking with lift trucks in zone/wave picking systems. Either the ASRS or the lift truck
operator delivers the pallet load to the conveyor. The conveyor system then delivers the pallet to the shipping area where it is either manually sorted by lift trucks into the designated staging lane, or a sortation system automatically sorts into a staging lane. Staging lanes can be equipped with automated or gravity fed unit-load conveyor. (Piasecki, 2001).

- **Bar-code scanners**: Bar-code scanners are very commonly used in pallet-pick operations. (Piasecki, 2001).
- **Voice-directed picking**: Voice technology has come of age in recent years and is now a very viable solution for piece pick, case pick, or pallet pick operations. (Piasecki, 2001).
- **Lift trucks**: The lift trucks used for pallet picking will depend upon the storage configuration. Standard lift trucks are used in bulk floor storage and wide-aisle pallet rack storage in singe-depth, push-back, drive-in/drive-thru, and flow rack. Reach trucks are used in narrow-aisle storage in single-depth, double-deep, push-back, drive-in/drive-thru, and flow rack. Swing mast and turret trucks are used in very narrow aisle storage in single depth pallet rack. (Piasecki, 2001).

### 3.8 Packaging

Simple actions such as developing an employee designed pack station can afford productivity improvements for the packing function. The proper size, height, and configuration will make a big difference in attitude and performance. A focus on improving the functions where the most people spend their time will maximize the potential savings. (Curtis Barry & Company, 2011).

If you want to explore some basic automation possibilities, one place to start is to install powered conveyor in the packing and shipping functions. The movement of boxes between functions can be expedited with horizontal conveyors that save overall time. Any reduction in travel time for highly repetitive and high frequency activities gains the most benefit. (Curtis Barry & Company, 2011).

### 3.9 Shipping Function

**Designate only two or three standard shipping cartons**: With only two or three boxes to choose from — plus a few custom sizes if necessary — pickers will put orders together faster. Cutting down on sizes optimizes freight expenses and reduces corrugated spend. It also makes it easier to support a pick-path methodology. (Stolarczyk).
Outbound shipments should always have some type of a check in place. The type of check will vary from operation to operation. In a high-volume, low-value shipping operation, *a simple “looking over” the shipment may be all that's feasible.* (Piasecki, 2001).

### 3.10. Safety and Overall Condition of the Facility

*Creating a safer workplace* will reduce damage to and loss of warehouse equipment and fixtures along with stored inventory. Also, determining hazard classifications and code requirements is a great way to help ensure safety in a warehouse. (Collins, *Best Practices for Warehouse Safety*, 2009).

**Some Order Through Striping:** Make sure to designate floor storage and staging areas with striping. You can’t do too much floor striping. Use tape and/or paint to designate floor areas approved for storage or material staging. It will bring order because everyone will know exactly where to perform certain activities.

**Do More Than the Minimum:** Codes and compliance are only intended to provide a certain minimum level of safety. The final recommendation when planning or incorporating safety into your operation is to look to the future. Consider a design that is flexible and capable of handling a higher hazard classification. If your business changes and the products you are taking into inventory become more dangerous, or flammable, etc, it can be very expensive to upgrade to accommodate the higher hazard classification.

Any warehouse can be made more productive and efficient by simply *making sure the warehouse is well maintained, organized, and clean.* Many times we enter a warehouse and within 30 seconds can tell what kind of operation we will see. A dirty, cluttered and disorganized facility is invariably more costly to operate than one that pays attention to the overall condition of the facility. (Curtis Barry & Company, 2011).

### 3.11. Control

Some warehouses do not utilize a standard form of assigning warehouse locations to individual storage positions in the warehouse. This leads to confusion and inefficiency. Make sure you *implement a location numbering system* that can be used to easily and systematically identify each warehouse location. A numbering schema that utilizes some form of identifying the zone, aisle, bay, level, and position for locations is recommended. (Curtis Barry & Company, 2011).
### 3.12. Summary of Best Practices

*Table 7: Summary of best-practices.*

<table>
<thead>
<tr>
<th>Area</th>
<th>Best Practices</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receiving and Inspecting</td>
<td>Inspect shipments immediately</td>
</tr>
<tr>
<td></td>
<td>Create a trouble zone</td>
</tr>
<tr>
<td>Unloading</td>
<td>Cross docking</td>
</tr>
<tr>
<td></td>
<td>Advanced Shipping Notices</td>
</tr>
<tr>
<td></td>
<td>Future workload planning</td>
</tr>
<tr>
<td>Put-Away</td>
<td>Barcoding</td>
</tr>
<tr>
<td></td>
<td>RFID</td>
</tr>
<tr>
<td></td>
<td>Locate directly to the picking location</td>
</tr>
<tr>
<td></td>
<td>Locate near eventual pick locations</td>
</tr>
<tr>
<td></td>
<td>Pick locations based on how often the product is shipped</td>
</tr>
<tr>
<td></td>
<td>Put-away directly from receipt to final location</td>
</tr>
<tr>
<td>Storage Function</td>
<td>Create a warehouse within a warehouse</td>
</tr>
<tr>
<td></td>
<td>Provide a variety of storage types and sizes</td>
</tr>
<tr>
<td></td>
<td>Reserve or overflow storage area</td>
</tr>
<tr>
<td>General</td>
<td>Concentrate on picking optimization over receiving optimization</td>
</tr>
<tr>
<td></td>
<td>Reducing walking time</td>
</tr>
<tr>
<td></td>
<td>Minimizing travel time between picking locations</td>
</tr>
<tr>
<td></td>
<td>Manage the flow of orders in the pick area</td>
</tr>
<tr>
<td>Picking</td>
<td>Paper-pick-tickets</td>
</tr>
<tr>
<td>Technology and Labelling Methods</td>
<td>Combined shipping label/pick documents</td>
</tr>
<tr>
<td></td>
<td>Hand-held radio-frequency (RF) terminals and portable label printers</td>
</tr>
<tr>
<td></td>
<td>Pick-to-light technology</td>
</tr>
<tr>
<td></td>
<td>Voice recognition technology</td>
</tr>
<tr>
<td><strong>Methodology</strong></td>
<td>Picker-To-Part</td>
</tr>
<tr>
<td>----------------</td>
<td>----------------</td>
</tr>
<tr>
<td></td>
<td>Part-To-Picker</td>
</tr>
<tr>
<td></td>
<td>Pick To Box</td>
</tr>
<tr>
<td></td>
<td>Slottting your fastest moving stock keeping units in the waist-to-shoulder area</td>
</tr>
<tr>
<td></td>
<td>Single-order picking</td>
</tr>
<tr>
<td></td>
<td>Multi-order/batch picking</td>
</tr>
<tr>
<td></td>
<td>Wave picking</td>
</tr>
<tr>
<td></td>
<td>Zone picking</td>
</tr>
<tr>
<td><strong>Picking</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Methodology</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Related to Full Pallet-Picking</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Unit-load picking</td>
</tr>
<tr>
<td></td>
<td>Piece pick</td>
</tr>
<tr>
<td></td>
<td>Case pick</td>
</tr>
<tr>
<td></td>
<td>Basic pallet picking</td>
</tr>
<tr>
<td></td>
<td>Task interleaving</td>
</tr>
<tr>
<td><strong>Pallet-Picking</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Equipment</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pallet rack</td>
</tr>
<tr>
<td></td>
<td>Automated conveyor and sortation systems</td>
</tr>
<tr>
<td></td>
<td>Voice-directed picking</td>
</tr>
<tr>
<td></td>
<td>Lift trucks</td>
</tr>
<tr>
<td><strong>Packaging</strong></td>
<td>Focus on improving the functions where the most people spend their time</td>
</tr>
<tr>
<td></td>
<td>Install powered conveyor in the packing and shipping functions</td>
</tr>
<tr>
<td><strong>Shipping Function</strong></td>
<td>Designate only two or three standard shipping cartons</td>
</tr>
<tr>
<td></td>
<td>A simple &quot;looking over&quot; the shipment may be all that's feasible</td>
</tr>
<tr>
<td><strong>Safety and Overall Condition of the Facility</strong></td>
<td>Creating a safer workplace</td>
</tr>
<tr>
<td></td>
<td>Some Order Through Striping</td>
</tr>
<tr>
<td></td>
<td>Do More Than the Minimum</td>
</tr>
<tr>
<td></td>
<td>Making sure the warehouse is well maintained, organized, and clean</td>
</tr>
<tr>
<td><strong>Control</strong></td>
<td>Implement a location numbering system</td>
</tr>
</tbody>
</table>
Chapter 4: Projection of the Future Operational Requirements

4.1. Business Growth

African Dynamics’s products values (Rand/ton) vary significantly. The growth of the turnover exceeds that of the product volume. This is due to two reasons:

I. African Dynamics is focussing on promoting the growth of high value products.

II. Annual inflation.

For the foreseeable future, the manufacturing operations of Gauteng, Mpumalanga and Limpopo will remain in Gauteng (i.e. will be situated at the new facility in Sunderland Ridge). However, the warehousing of Limpopo and Mpumalanga products will be moved to Groblersdal. This entails that for the new facility, the manufacturing operations will grow faster than the warehousing operations.

Table 8: Annual gross volumes distributed.

<table>
<thead>
<tr>
<th>Year (ended 28 February)</th>
<th>Gross Volume (Tons)</th>
<th>% Increase from Previous Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>95</td>
<td>-</td>
</tr>
<tr>
<td>2010</td>
<td>115</td>
<td>21.05</td>
</tr>
<tr>
<td>2011</td>
<td>157</td>
<td>36.52</td>
</tr>
<tr>
<td>2012</td>
<td>230</td>
<td>46.50</td>
</tr>
<tr>
<td>2013 (forecast)</td>
<td>255</td>
<td>10.87</td>
</tr>
<tr>
<td>2014 (forecast)</td>
<td>300</td>
<td>17.65</td>
</tr>
</tbody>
</table>

Note: The average growth from 2009 to 2012 was 35% per year. However, 2013 and 2014 forecasts are much lower. This is because the forecast data for year end 2013 and 2014 is only for tenders that have been secured. More tenders are in the process of being secured. It can therefore be assumed that this will raise the “% Increase from Previous Year” to at least 30%. This provides a risk allowance of 5% (30% instead of 35%).

The product volume forecast for financial year-end 28 February 2015 is calculated as follows:

\[
\text{Projected}_{2015} = \text{Current}_{2012} (1 + 0.30)^{2015-2012}
\]

\[
\text{Projected}_{2015} = 2.2
\]

This means that the business will grow by a massive 220%, in only 3 years.
4.2. Production

The manufacturing area has a large amount of equipment that will not be able to be moved (or at least easily), once located. The manufacturing area therefore absolutely needs to have enough capacity to at least fulfil the demand as at financial year end February 2017. The table below represents the space requirements for the production area.

Table 9: Space requirements for the production area in 2017.

<table>
<thead>
<tr>
<th>Air controlled room</th>
<th>Equipment</th>
<th>Quantity</th>
<th>Space Required (m²)</th>
<th>Total Space Required (m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ribbon blender</td>
<td>2</td>
<td>32</td>
<td></td>
<td>64</td>
</tr>
<tr>
<td>Conveyor</td>
<td>2</td>
<td>2</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Jar filler</td>
<td>1</td>
<td>15</td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>Custard jar filler</td>
<td>1</td>
<td>25</td>
<td></td>
<td>25</td>
</tr>
<tr>
<td>Conveyor (for expiry date printing)</td>
<td>2</td>
<td>2</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Forklift space</td>
<td></td>
<td></td>
<td></td>
<td>35</td>
</tr>
<tr>
<td>Space requirement for air controlled room</td>
<td></td>
<td></td>
<td></td>
<td>147</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Elevated slab</th>
<th>Equipment</th>
<th>Quantity</th>
<th>Space Required (m²)</th>
<th>Total Space Required (m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Form, fill and seal</td>
<td>4</td>
<td>9</td>
<td></td>
<td>36</td>
</tr>
<tr>
<td>Auger filler</td>
<td>2</td>
<td>4</td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>Ribbon blender</td>
<td>3</td>
<td>32</td>
<td></td>
<td>96</td>
</tr>
<tr>
<td>Nauta mixer</td>
<td>4</td>
<td>8</td>
<td></td>
<td>32</td>
</tr>
<tr>
<td>Metal detector</td>
<td>5</td>
<td>6</td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>Band sealer</td>
<td>3</td>
<td>6</td>
<td></td>
<td>18</td>
</tr>
<tr>
<td>Stitching machine</td>
<td>2</td>
<td>9</td>
<td></td>
<td>18</td>
</tr>
<tr>
<td>Pallet jack space</td>
<td></td>
<td></td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>Loading Area</td>
<td></td>
<td></td>
<td></td>
<td>18</td>
</tr>
<tr>
<td>Space requirement for elevated slab</td>
<td></td>
<td></td>
<td></td>
<td>286</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Open area</th>
<th>Equipment</th>
<th>Quantity</th>
<th>Space Required (m²)</th>
<th>Total Space Required (m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Form, fill and seal</td>
<td>2</td>
<td>9</td>
<td></td>
<td>18</td>
</tr>
<tr>
<td>Conveyor</td>
<td>3</td>
<td>2</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>Metal detector</td>
<td>2</td>
<td>3</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>Fully automatic Box machine</td>
<td>3</td>
<td>25</td>
<td></td>
<td>75</td>
</tr>
<tr>
<td>Conveyor (for expiry date printing)</td>
<td>2</td>
<td>2</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Forklift</td>
<td></td>
<td></td>
<td></td>
<td>100</td>
</tr>
<tr>
<td>Space requirement for open area</td>
<td></td>
<td></td>
<td></td>
<td>209</td>
</tr>
<tr>
<td>General Temporary Storage Area</td>
<td></td>
<td></td>
<td></td>
<td>280</td>
</tr>
<tr>
<td><strong>Total space requirements</strong></td>
<td></td>
<td></td>
<td></td>
<td>922</td>
</tr>
</tbody>
</table>
4.3. Warehousing

4.3.1. Calculation Explanation

The data for outbound goods for September 2012 was used to calculate the warehouse space required. Peak conditions were incorporated. The space was calculated as follows. Calculations provided in Appendix A:

*Note:* (Referring to Appendix A) Peas and beans are split from fruit and vegetables as a product type. Peas and beans are always ordered in the same quantity, but the rest of the fruit and vegetable product mix differs but remains as a total quantity of about 200 pallets.

- In Appendix A, the table is headed with columns “A” to “O”. The data for columns “B” to “E”, “H” and “I” was provided by the company.
- Column “E” represents the number of items for September 2012. However, September only has 19 feeding days and the maximum feeding days in a month is 23 (the peak volume for a month). Therefore column “E” was multiplied by a ratio of 23/19 to obtain the data for column “F”. This however only applies to wholesale goods, i.e. not to manufactured goods; refer to column “C”.
- The projected number of goods for a peak month was calculated by multiplying column “F” by the growth factor of 2.2 (220%), see Chapter 4.1.
- The data provided in column “H” is based upon the data in column “D”. Pallets carry a maximum load of 1 ton; i.e. 40 x 25kg bags = 1 ton, 100 x 10kg bags = 1 ton and so on.
- Column “I” is calculated by dividing column “G” by column “H” and then rounding up.
- The data for column “I” is based upon column “D”. The heavier the product is, the stronger the product’s packaging is, the more pallets can be stacked on top of one another.
- Column “K” takes into the account the fact that some products don’t fit perfectly onto a pallet. For example, fruits and vegetables overlap on each side of the width (one metre) by 0.1 metres, i.e. the space required for vegetables is length x increased width = (1.2) x (1 + 2x0.1) = 1.44 m².
- Column “L”, “M”, “N” and “O” represent the different storage approaches. The different storage approaches are described in more detail in the following sub-chapter.
4.3.2. Warehouse Storage Approaches

It is important to maximise the usage of volume in a warehouse, by considering not only width and length, but height as well. That is where the discussion of pallet racks versus block stacking comes into play. Pallets racks obviously utilize the third dimension of height the best, but have a few ramifications:

- Higher investment cost required,
- Can the facility house 4 levels of pallet racks? --- Yes
- Can the forklifts extend that high? --- Yes
- Do the forklifts have narrow turning circles (1.8 metres) so as to minimise aisle space needed? --- No, currently they have turning circles of 3 metres, but in the future perhaps.

Products are grouped as 4 different types according to how high their pallets can be stacked:

- Group 1: Not stackable
- Group 2: Stackable two high
- Group 3: Stackable three high
- Group 4: Stackable four high

4 Storage approaches are proposed, based on combinations of the 4 product groups, by making use of 2 techniques:

- Approach i: Only block stacking,
- Approach ii: Pallet racks for group 1 products, block stacking for group 2, 3 and 4 products,
- Approach iii: Pallet racks for group 1 and 2 products, block stacking for group 3 and 4 products,
- Approach iv: Pallet racks for group 1, 2 and 3 products, block stacking for group 4 products.

Note: If, for example, approach B is chosen, group 2 products can also be stacked on the pallet racks if there is extra room. However, this situation will not be analysed as it is assumed that having a bit more extra space is not a problem.
The descriptive summary of these approaches is presented in the table below:

**Table 10: Pallet storage approaches.**

<table>
<thead>
<tr>
<th>Pallet Storage Approach</th>
<th>i</th>
<th>ii</th>
<th>iii</th>
<th>iv</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pallets Stackable 1 High (i.e. Not Stackable)</td>
<td>Block Stacking</td>
<td>Pallet Racks</td>
<td>Pallet Racks</td>
<td>Pallet Racks</td>
</tr>
<tr>
<td>Pallets Stackable 2 High</td>
<td>Block Stacking</td>
<td>Block Stacking</td>
<td>Pallet Racks</td>
<td>Pallet Racks</td>
</tr>
<tr>
<td>Pallets Stackable 3 High</td>
<td>Block Stacking</td>
<td>Block Stacking</td>
<td>Block Stacking</td>
<td>Pallet Racks</td>
</tr>
<tr>
<td>Pallets Stackable 4 High</td>
<td>Block Stacking</td>
<td>Block Stacking</td>
<td>Block Stacking</td>
<td>Block Stacking</td>
</tr>
<tr>
<td>Block Stacking</td>
<td>none</td>
<td>1</td>
<td>1,2</td>
<td>1,2,3</td>
</tr>
<tr>
<td>(for pallets stackable)</td>
<td>1,2,3,4</td>
<td>2,3,4</td>
<td>3,4</td>
<td>4</td>
</tr>
</tbody>
</table>

*Note: The last two rows are a summary of the first four rows.*

The capacity required for Phase 1 of the new facility varies based on the storage approach used. This was taken into consideration upon design. A cost analysis was also performed.

**4.3.3. Forklift Selection**

Before we get to the metres squared of warehousing space required, there is one more crucial factor. It relates to material handling equipment; ordinary diesel-powered forklifts versus narrow aisle forklifts. Four ordinary diesel-powered forklifts are already owned by the company. They have a turning circle of 3 metres. However, narrow aisle forklifts have a turning circle of 1.8 metres. But, the company would have to invest in at least three narrow aisle forklifts, if that decision was made.

The current forklifts, with a turning circle of 3 metres, will be used for all the block stacking of pallets. The block stacking aisle factor (AF) is calculated as follows:

\[
Block \, stacking \, AF = \frac{Aisle \, space + \, Rack \, storage \, on \, either \, side \, of \, aisle}{Rack \, storage \, on \, either \, side \, of \, aisle}
\]

\[
Block \, stacking \, AF = \frac{3 + 2 \times 1.1}{2 \times 1.1} = 1.68
\]
The current forklifts are the 1st option for moving the pallets to and from the pallet racks. Based on a forklift with a turning circle (TC) of 3 metres, the pallet rack aisle factor is calculated as follows:

\[
Pallet\ rack\ AF\ 3m\ TC = \frac{Aisle\ space + 2 \times Rack\ storage\ on\ either\ side\ of\ aisle}{2 \times Rack\ storage\ on\ either\ side\ of\ aisle}
\]

\[
Pallet\ rack\ AF\ 3m\ TC = \frac{3 + 2 \times 1.1 + 2 \times 1.1}{2 \times 1.1 + 2 \times 1.1}
\]

\[
Pallet\ rack\ AF\ 3m\ TC = 2.36
\]

The narrow aisle forklifts are the 2nd option for moving the pallets to and from the pallet racks. Based on a forklift with a turning circle (TC) of 1.8 metres, the pallet rack aisle factor is calculated as follows:

\[
Pallet\ rack\ AF\ 1.8m\ TC = \frac{Aisle\ space + 2 \times Rack\ storage\ on\ either\ side\ of\ aisle}{2 \times Rack\ storage\ on\ either\ side\ of\ aisle}
\]

\[
Pallet\ rack\ AF\ 1.8m\ TC = \frac{1.8 + 2 \times 1.1 + 2 \times 1.1}{2 \times 1.1 + 2 \times 1.1}
\]

\[
Pallet\ rack\ AF\ 1.8m\ TC = 1.82
\]

4.3.4. Summary
The following two tables show how space can even be further reduced if a narrow aisle forklift is used. The tables represent the sum of the data in Appendix A, columns “L”, “M”, “N” and “O”. The data was summated and then multiplied by the respective aisle factors (AF). In summary the factors that considerably influence the warehousing space required are:

- Pallet storage method,
- Type of forklift used.
Table 11: Space requirements for the four different storage approaches – for a forklift with a turning circle of 3 metres.

<table>
<thead>
<tr>
<th></th>
<th>Pallet Storage Approach i</th>
<th>Pallet Storage Approach ii</th>
<th>Pallet Storage Approach iii</th>
<th>Pallet Storage Approach iv</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block Stacked - m² Required</td>
<td>9457</td>
<td>3558</td>
<td>3242</td>
<td>1594</td>
</tr>
<tr>
<td>Pallet Racks - m² Required</td>
<td>0</td>
<td>2101</td>
<td>2336</td>
<td>4075</td>
</tr>
<tr>
<td>Total - m² Required</td>
<td>9457</td>
<td>5659</td>
<td>5578</td>
<td>5669</td>
</tr>
<tr>
<td>% Reduction in Space Required</td>
<td>0.00</td>
<td>40.16</td>
<td>41.02</td>
<td>40.05</td>
</tr>
</tbody>
</table>

Note: “% Reduction in Space Required” refers to how much space can be saved by using approach ii, iii and iv as opposed to approach i.

Table 12: Space requirements for the four different storage approaches – for a forklift with a turning circle of 1.8 metres.

<table>
<thead>
<tr>
<th></th>
<th>Pallet Storage Approach i</th>
<th>Pallet Storage Approach ii</th>
<th>Pallet Storage Approach iii</th>
<th>Pallet Storage Approach iv</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block Stacked - m² Required</td>
<td>9457</td>
<td>3558</td>
<td>3242</td>
<td>1594</td>
</tr>
<tr>
<td>Pallet Racks - m² Required</td>
<td>0</td>
<td>1616</td>
<td>1797</td>
<td>3135</td>
</tr>
<tr>
<td>Total - m² Required</td>
<td>9457</td>
<td>5174</td>
<td>5039</td>
<td>4729</td>
</tr>
<tr>
<td>% Reduction in Space Required</td>
<td>0.00</td>
<td>45.29</td>
<td>46.72</td>
<td>49.99</td>
</tr>
</tbody>
</table>
4.4. Tender Parcels

There is a demand for a new proposal for the tender called “Parcels”. The tender is likely to be awarded to African Dynamics. The tender entails 12 500 parcels be produced and distributed on a weekly basis. The product mix and space requirements are listed in the table below:

**Table 13: Storage space required for tender parcels.**

<table>
<thead>
<tr>
<th>Description</th>
<th>Weight (kg)</th>
<th>Quantity Per Parcel</th>
<th>Quantity Per 50000 Parcels</th>
<th>Num of Pallets Per Month</th>
<th>Stackable – How Many Pallets High</th>
<th>m² Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maize Meal</td>
<td>12.5</td>
<td>1</td>
<td>50000</td>
<td>625</td>
<td>3</td>
<td>250.8</td>
</tr>
<tr>
<td>Sugar Beans</td>
<td>5</td>
<td>1</td>
<td>50000</td>
<td>250</td>
<td>3</td>
<td>100.8</td>
</tr>
<tr>
<td>Samp</td>
<td>5</td>
<td>1</td>
<td>50000</td>
<td>250</td>
<td>3</td>
<td>100.8</td>
</tr>
<tr>
<td>Sugar</td>
<td>5</td>
<td>1</td>
<td>50000</td>
<td>250</td>
<td>3</td>
<td>100.8</td>
</tr>
<tr>
<td>Bread Flower</td>
<td>5</td>
<td>1</td>
<td>50000</td>
<td>250</td>
<td>3</td>
<td>100.8</td>
</tr>
<tr>
<td>Salt</td>
<td>1</td>
<td>1</td>
<td>50000</td>
<td>50</td>
<td>2</td>
<td>30</td>
</tr>
<tr>
<td>Oil</td>
<td>0.75</td>
<td>1</td>
<td>50000</td>
<td>100</td>
<td>1</td>
<td>120</td>
</tr>
<tr>
<td>Soya Mince</td>
<td>1</td>
<td>2</td>
<td>100000</td>
<td>134</td>
<td>2</td>
<td>80.4</td>
</tr>
<tr>
<td>Pilchards</td>
<td>0.425</td>
<td>4</td>
<td>200000</td>
<td>112</td>
<td>4</td>
<td>33.6</td>
</tr>
<tr>
<td>Rice</td>
<td>5</td>
<td>1</td>
<td>50000</td>
<td>250</td>
<td>3</td>
<td>100.8</td>
</tr>
<tr>
<td>Milk</td>
<td>1</td>
<td>6</td>
<td>300000</td>
<td>334</td>
<td>1</td>
<td>400.8</td>
</tr>
<tr>
<td>Margarine</td>
<td>0.5</td>
<td>2</td>
<td>100000</td>
<td>60</td>
<td>2</td>
<td>36</td>
</tr>
<tr>
<td>12FP Immunomeal</td>
<td>1</td>
<td>2</td>
<td>100000</td>
<td>134</td>
<td>2</td>
<td>80.4</td>
</tr>
<tr>
<td>Nutri Drink</td>
<td>1</td>
<td>1</td>
<td>50000</td>
<td>67</td>
<td>2</td>
<td>40.8</td>
</tr>
<tr>
<td>Peanut Butter</td>
<td>1</td>
<td>1</td>
<td>50000</td>
<td>84</td>
<td>1</td>
<td>100.8</td>
</tr>
<tr>
<td>Tea Bags</td>
<td>200</td>
<td>1</td>
<td>50000</td>
<td>17</td>
<td>1</td>
<td>20.4</td>
</tr>
<tr>
<td>Sack Pollyprop</td>
<td>1</td>
<td>50000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Box Stock 5 Double Wall</td>
<td>1</td>
<td>50000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Pallets</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3186</td>
</tr>
<tr>
<td>Packaging</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>200</td>
</tr>
<tr>
<td>Extra Space for Pilchards</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2001.8</td>
</tr>
</tbody>
</table>

**Note 1:** A worst case-scenario was considered, whereby a monthly cycle is used and all the parcels raw materials are received at once, then produced, then stored and then distributed.

**Note 2:** The extra space for pilchards is due to the fact that pilchards are delivered as a fixed amount of 67 000 units on a link, and only 50 000 units are needed.

The best case scenario were to be if the parcels could be produced and distributed from the new facility, but due to capacity constraints this option may not be viable. If so, the parcels will have to be produced from the current facility (assuming that all current operations are moved to the new facility, allowing space for the parcels).

The decision of locating the tender parcels in the new facility versus the current facility will be represented further on in the report.
4.5. **Construction Phases**

It has been decided that the new facility will be built in two phases for cash flow purposes. The plan is:

- Phase 1 - the demand for February 2015 (year-end) will be met,
- Phase 2 - the construction of further warehousing area and a plant for manufacturing soya mince have been proposed. This is based on remaining area available on the plot.

Due to budget constraints it has been decided by the company that phase 1 will be built on a sub-division of the entire plot, i.e. 15000m² will be used for phase 1 from a total land area of 28844m² (see Appendix B). Restrictions exist and are set as no more than 50% of the ratio of buildings area to total land area. This means that there is a maximum of 7500m² available for the facilities buildings.
Chapter 5: Design Requirements and Considerations for the New Facility

5.1. General
The design requirements for the new facility are primarily structured around the proposed process flow represented in Figure 8. The Operational estimations and design specifications are both quantitative and qualitative.

The new facility design is required to provide for:

- Optimum storage,
- Multiple distribution interfaces,
- Improved security and control measures,
- Flexibility,
- Centralised,
- Expandable.

The premises is required to consist of:

- Offices – 375 m² - 2 levels,
- Product innovation labs – 120 m²,
- Production area,
- Raw materials storage area – 500 m²,
- Warehousing,
- Workers canteen & eating area – 90 m²,
- Workers bathroom & changing area (mens) – 130 m²,
- Workers bathroom & changing area (womens) – 100 m²,
- Parking for:
  - Visitors – 5 bays,
  - Personnel – 45 bays,
  - Deliveries,
  - Shipments,
- Security point(s),
- Refuse area – 6 bins - each 4 x 2 m,
- Testing lab – 40 m².
Figure 8: Proposed Process Flow for the New Facility.

1) Security Check Area → Vehicle queues
2) Queuing Area → Vehicle parks to be unloaded
3) Receiving Area → Unloaded to temporary storage

4) Accumulation Area

Goods used in production

5) Raw Material Storage Area → Goods moved to manufacturing
6) Manufacturing Area → Manufactured goods stored

7) Warehouse

Wholesale products directly warehoused

8) Parcel Packaging Area

Products for food parcels picked for packaging
Packaged products moved back to storage

9) Picking Bay → Products picked for shipment
10) Shipping Area → Vehicle proceeds to exit

11) Vehicle Inspection Area

Vehicle exits premises
5.2. Location

African Dynamics has decided to build the new facility at Westhills Business Estate Owner’s Association, Sunderland Ridge, Centurion.

The design guidelines set-out by Westhills Business Estate Owner’s Association need to be adhered to, see Appendix C. The stand has dimensions 132.43 by 195.26 by 168.08 by 191.97 metres, making up a plot of size 28844 m². See Appendix B.

5.3. Security

Preferably, only one security point should be allocated for incoming and outgoing vehicles. However, that is only possible if:

1) there is sufficient space for the 34 tonners to enter the facility, unload/load goods and exit the facility taking into account the turning circle of 40 m (refer to Chapter 2.1.4). Links can't reverse very far.

2) there is enough space for the 34 tonners, 36 metres in length, to park in the entrance alley before passing through the checkpoint. The security guards will then first be able to check the delivery details and keep things under control.

One truck needs to be accommodated at a time. The truck should not be parked in or extend onto the street, but at the same time it should not be allowed onto the premises. It is to be stationed at the entrance boom whilst the security guard checks the vehicle and the required documentation is completed.

Having only one area for both entrance and exit (although the area may have multiple booms) is an industry best practice to maintain higher levels of security and control:

a. Entrance gates:
   i. Firstly for supplier/ customer vehicles to enter,
   ii. Secondly for personnel vehicles to enter.

b. Exit gates:
   i. Firstly for supplier/ customer vehicles to exit,
   ii. Secondly for personnel vehicles to exit.
5.4. Offices

The architect will draw detailed plans of the offices. The design should allow for 2 levels, each 375 m². Offices should be north facing. Provision needs to be made for 42 staff members, boardrooms, toilets and kitchens:

Table 14: Future office personnel requirements.

<table>
<thead>
<tr>
<th>Employee</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>HR</td>
<td>1</td>
</tr>
<tr>
<td>Facilities</td>
<td>1</td>
</tr>
<tr>
<td>Business Developers</td>
<td>13</td>
</tr>
<tr>
<td>Product Innovation</td>
<td>4</td>
</tr>
<tr>
<td>Admin/ Procurement</td>
<td>13</td>
</tr>
<tr>
<td>OPS</td>
<td>2</td>
</tr>
<tr>
<td>Line Managers</td>
<td>8</td>
</tr>
<tr>
<td>Boardroom</td>
<td>3</td>
</tr>
<tr>
<td>Toilets</td>
<td>8</td>
</tr>
<tr>
<td>Kitchen</td>
<td>1</td>
</tr>
</tbody>
</table>

5.5. Queuing Area

- Space required for 6 x 34 tonners (peak periods)

*Note: Assume that if there is a smaller vehicle, it will be able to park in the same area that is designated to the 34 tonners.*

5.6. Unloading Area

- Must be able to unload at least 2 x 34-ton trucks simultaneously,
- Unloading time: must be reduced from 45 minutes per truck to 30 minutes per truck,
- Equipment used: forklifts and manual labour.

5.7. Accumulation Area

- Pallets not stacked,
- Space for at least 40 pallets.
5.8. **Storage**
Service Level Agreements with suppliers have been decided upon. Products will be delivered in the configuration:

- 25kg bags x 40 bags on a pallet = 1 ton
- 10kg bags x 100 bags on a pallet = 1 ton
- 5kg bags x 200 bags on a pallet = 1 ton (when possible)

5.9. **Unit Load Size**
The standard pallet size of 1 x 1,2 metres will be used. The current pallet size is effective for holding and moving of the company's low value and heavy products. Also, it is standardised along the supply chain, which means a lower landed cost.

However, some of the products overlap the standard pallet sizes when packed. This needs to be considered in the design.

5.10. **Production**
A total space of 922 m² is required, but to add allowance it will be 1000m². The production design must be based upon the requirements stated in Chapter 4.2. For this project, a detailed design of the production area will not be done.

5.11. **Warehouse Storage**
Construction phase 1 allows for a maximum of 7500 m² to be built. The following table determines how much warehousing space is available, based on the other facilities' requirements. The warehouse area can therefore be a maximum of 7500 – 2355 = 5145 m².

*Table 15: Departments within the facility and their space requirement.*

<table>
<thead>
<tr>
<th>Department Type</th>
<th>Space Required (m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offices</td>
<td>375</td>
</tr>
<tr>
<td>Product innovation labs</td>
<td>120</td>
</tr>
<tr>
<td>Production area</td>
<td>1000</td>
</tr>
<tr>
<td>Raw materials storage area</td>
<td>500</td>
</tr>
<tr>
<td>Workers canteen &amp; eating area</td>
<td>90</td>
</tr>
<tr>
<td>Workers bathroom &amp; changing area (mens)</td>
<td>130</td>
</tr>
<tr>
<td>Workers bathroom &amp; changing area (womens)</td>
<td>100</td>
</tr>
<tr>
<td>Testing lab</td>
<td>40</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2355</strong></td>
</tr>
</tbody>
</table>
The following four graphs show the different space requirements for each of the four storage approaches, and for each of the two forklifts. Refer to Chapter 4.3 for more information. They are based upon the data in Table 11 and Table 12. It is interesting to see how the space drastically drops from approach i to approach ii.

**Figure 9:** Line chart representing the % space reduction when using approach ii, iii or iv as opposed to the company’s current approach (approach i) – for the current forklifts.

**Figure 10:** Bar chart representing the space requirements for each of the four storage approaches - for the current forklifts.
Figure 11: Line chart representing the % space reduction when using approach ii, iii or iv as opposed to the company’s current approach (approach i) – for the narrow aisle forklifts.

![Narrow Aisle Forklift - Pallet Racks vs Block Stacking](image1)

Figure 12: Bar chart representing the space requirements for each of the four storage approaches - for the narrow aisle forklifts.

![Narrow Aisle Forklift - Block Stacking vs Pallet Racks Storage Approaches](image2)

5.12. Picking

African dynamics would ideally like to have 10 picking bays, in a combination of different sizes. Trucks are picked normally at a rate of 1 per hour.
5.13. Shipping

The number of links (34 tonners) shipped per day is:

- Currently: 6
- Optimally: 9

The number of 8 tonners shipped per day is:

- Currently: 20
- Optimally: 30

The current rate of loading is:

- If products are loaded with pallets: ½ hour
- If products are loaded loosely: 1 ½ hours
Chapter 6: Proposed Conceptual Designs for the New Facility

6.1. Defining Feasible Alternatives

The design of the entire premises has an impact on the design of the warehouse. The warehouse design will be based upon three things:

- The best-practices survey,
- The calculations based upon Appendix A and analysed in Chapter 5.11,
- Input from the African Dynamics team.

The following matrix represents the possible warehouse designs. The ticks mark the feasible alternatives.

Table 16: Feasible alternatives for the warehouse design.

<table>
<thead>
<tr>
<th></th>
<th>Pallet Storage Approach i</th>
<th>Pallet Storage Approach ii</th>
<th>Pallet Storage Approach iii</th>
<th>Pallet Storage Approach iv</th>
<th>FIFO Principle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Forklift</td>
<td>a</td>
<td>✓ b</td>
<td>✓ c</td>
<td>✓ d</td>
<td>✓ j</td>
</tr>
<tr>
<td>3 m Turning Circle</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>New Forklift</td>
<td>e</td>
<td>✓ f</td>
<td>✓ g</td>
<td>✓ h</td>
<td></td>
</tr>
<tr>
<td>1.8 m Turning Circle</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Alternatives “b”, “c”, “d”, “f”, “g” and “h” were considered. Alternatives “a” and “e” are infeasible as they require over 9000 m² of storage space. The number of 3 high stackable pallets stored with pallets racks was only slightly more than 2 high stackable pallets. Therefore, it is not worth drawing up separate designs for “c” and “g”, “d” and “h” require the highest investment cost. Due to the company being under such a tight budget, “d” and “h” were not analysed.

A new alternative, alternative “j” is the final one to be considered. This alternative makes use of the FIFO principle by putting 4 pallet rack rows adjacent to each other, with no aisle space in between them. Previously 2 racks were placed adjacent to one another and could be access via aisle space. The FIFO method makes use of slanted racks (at a very small angle – less than 5 degrees). The pallets slowly glide from the “in” to the “out” by means of rollers, or as close as they can get to “out” before they rest behind another pallet. The great advantage of the FIFO system is that it reduces the aisle space in the facility by half, compared to the ordinary pallet rack system. This is because 4 pallets are stored next to one another, as opposed to only 2 pallets. However, it does come with a cost. The FIFO system will be considered as one of the designs.
Figure 13: Side view of FIFO rack system.

Alternatives “b”, “f” and “j” were chosen as the final 3 designs. If the company has remaining money in their budget they should look at upgrading “b” and “f” to “d” and “h” respectively. This can be easily achieved by replacing a portion of block stacking with pallet racks.
6.2. Design 1

6.2.1. Premises 1

The premises layout is based on trucks driving around the entire building, with the reasoning being that trucks have large turning circles and that this might be a solution to that problem.

Figure 14: Premises of Design 1.
6.2.2. Warehouse 1

The first design is based upon warehouse alternative “f”, refer to Table 16. An investment in a narrow aisle forklift is required for this alternative.

*Figure 15: Warehouse of Design 1.*
6.3. Design 2

6.3.1. Premises 2

The premises layout is based on the centralisation of operations in one area.

*Figure 16: Premises of design 2.*
6.3.2. Warehouse 2

The second design is based upon warehouse alternative “b”, refer to Table 16. No investment is required into new forklifts.

Figure 17: Warehouse of design 2.
6.4. Design 3

6.4.1. Premises 3

The premises layout is also based on the centralisation of operations in one area.

*Figure 18: Premises of design 3.*
6.4.2. Warehouse 3

The third design is based upon warehouse alternative “i”, refer to Table 16. No investment is required into new forklifts. However, the cost of the FIFO system will be high. The raw materials storage area and warehouse are combined in the design.

*Figure 19: Warehouse of design 3.*
### 6.5. Evaluation of Alternatives

**Table 17: Evaluation of alternatives.**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Weight</th>
<th>Design 1</th>
<th></th>
<th>Design 2</th>
<th></th>
<th>Design 3</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Rating</td>
<td>Score</td>
<td>Rating</td>
<td>Score</td>
<td>Rating</td>
<td>Score</td>
</tr>
<tr>
<td>Trouble zone</td>
<td>3</td>
<td>8</td>
<td>24</td>
<td>6</td>
<td>18</td>
<td>7</td>
<td>21</td>
</tr>
<tr>
<td>Overflow area</td>
<td>3</td>
<td>8</td>
<td>24</td>
<td>7</td>
<td>21</td>
<td>9</td>
<td>27</td>
</tr>
<tr>
<td>Storage capacity</td>
<td>5</td>
<td>7</td>
<td>35</td>
<td>8</td>
<td>40</td>
<td>9</td>
<td>45</td>
</tr>
<tr>
<td>Number of picking bays - Small</td>
<td>12</td>
<td>5</td>
<td>60</td>
<td>10</td>
<td>120</td>
<td>5</td>
<td>60</td>
</tr>
<tr>
<td>Number of picking bays - Medium</td>
<td>24</td>
<td>2</td>
<td>48</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>48</td>
</tr>
<tr>
<td>Number of picking bays - Large</td>
<td>40</td>
<td>2</td>
<td>80</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>80</td>
</tr>
<tr>
<td>Flexibility</td>
<td>10</td>
<td>7</td>
<td>70</td>
<td>6</td>
<td>60</td>
<td>7</td>
<td>70</td>
</tr>
<tr>
<td>Cost-effective</td>
<td>10</td>
<td>7</td>
<td>70</td>
<td>8</td>
<td>80</td>
<td>6</td>
<td>60</td>
</tr>
<tr>
<td>Allows for expansion</td>
<td>10</td>
<td>6</td>
<td>60</td>
<td>8</td>
<td>80</td>
<td>7</td>
<td>70</td>
</tr>
<tr>
<td>Product flow</td>
<td>8</td>
<td>4</td>
<td>32</td>
<td>9</td>
<td>72</td>
<td>7</td>
<td>56</td>
</tr>
<tr>
<td>Security &amp; Control</td>
<td>7</td>
<td>6</td>
<td>42</td>
<td>9</td>
<td>63</td>
<td>7</td>
<td>49</td>
</tr>
<tr>
<td>Temporary accumulation area</td>
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The table represents the criteria for the selection of the best candidate. The score for each design criteria is the weight for that criteria multiplied by the score for the respective design. Design 3 had the highest score because it fulfilled the most important criteria of picking bays, stock control, flexibility and expansion the best. Design 3 should therefore be implemented.

*Note: The weights and ratings both range from 1-10, except for picking bays weights. The picking bays weightings are equivalent to the number of pallets that can be accommodated in that respective picking bay.*
Chapter 7: Conclusion

7.1. Results

The 3rd design was chosen because it scored the highest in the weighted average ranking. The core concepts of the design are:

- The premises layout is based on the centralisation of operations in one area.
- The preferred storage method is a FIFO (First-In-First-Out) racking system.
- Use of current forklifts, i.e. no investment is required for forklifts.
- The raw materials storage and warehouse storage are in a single area.

The company gained:

- An in-depth survey of best-practices relating to the food manufacturing and distribution environment. Many of the best practices have been incorporated into the facility design(s) and more are recommended to be implemented into the day-to-day operations of the business so as to increase overall efficiency.
- Quantitative representation of the storage space required, based on the different storage methods proposed.
- Reduction in the total storage space required (see Figure 20).
- A warehouse that has multiple picking bays, allowing for optimal control of out-going stock.
- An efficient plant and warehouse layout that allows for effective stock-taking, minimises the chance of theft and has no unnecessary duplication of receiving or shipping areas.
- An integrated final design that allows for expansion and flexibility.
7.2. Recommendations

Based upon Design 3 (the most optimal design), the requirements for February 2015 are 5174 m². However, the available warehouse space is only 4450 m². Therefore, the company will either have to increase the size of Phase 1 or commence design and construction of Phase 2 earlier.

African Dynamics should implement the best-practices into their day-to-day business.

The project, along with the designs, has been successfully handed over to African Dynamics. African Dynamics may decide to consult with the student.
References


http://logistics.about.com/od/operationalsupplychain/a/order_pick.htm

http://logistics.about.com/od/tacticalsupplychain/a/wms_best_prac.htm


http://multichannelmerchant.com/opsandfulfillment/picking_packing_022007/

http://multichannelmerchant.com/opsandfulfillment/best_put-away/

http://multichannelmerchant.com/opsandfulfillment/material_handling_putaway/
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**Note:** The table above lists various products with their respective details such as Product Name, Type, Manufactured or Wholesale, and other associated data. The table continues with more entries for different product names and their details.
Appendix B: Westhills Business Estate – Site Plan
Appendix C: Westhills Business Estate Owner’s Association – Design Guidelines

1. INTRODUCTION

The purpose of this guide is to establish a secure and aesthetic environmental development within Westhill’s Business Estate Owner’s Association. Consequently the following design objectives will underpin all development:

* the creation of a landscaping theme which will create a park like continuity throughout the development

* the establishment of a cohesive mix of hard landscaping elements, e.g.: lighting, signage etc.

* The encouragement of a varied mix of architecturally attractive industrial buildings.

The detail relating to each of these objectives is set out clearly in this design manual. The purpose of this manual is to guide all development within the Estate and set minimum standards to ensure that the above-mentioned objectives are adhered to.

2. DESIGN PRINCIPLES

2.1 To achieve the identified objectives the following Design Principles will be applied, and will guide the development at Westhill’s Business Estate Owner’s Association:

2.1.1 Buildings should strive to express responsible environmental design and passive energy usage, such as sun control, orientation, etc.

2.1.2 Buildings, including parking areas, should be set against well-implemented and maintained landscaped environments.

2.1.3 The landscaping must be in line with applicable requirements detailed in the Environmental Management Plan and any amendment thereto, applicable to the Township.

3. DEVELOPER’S COMMITMENT

3.1 The developer will ensure that Westhill’s Business Estate Owner’s Association is established and that this design manual is incorporated into the constitution of the Estate Owner’s Articles of Association.
3.2 The developer will be responsible for the construction of:

* Boundary fence along the perimeter of the development;
* Entrance gate(s), control point and accompanying architectural features;
* Security Systems (perimeter and access control)

3.3 The developer will be responsible for the installations / establishment of soft and hard landscaping substantially in the accordance with the approved SDP for the Township:

4. PURCHASERS RESPONSIBILITIES

4.1 The Purchaser’s obligations are:

4.1.1 To familiarize themselves with the provisions of this Design Manual.

4.1.2 Improve his Erf in accordance with the provisions of this design guide.

4.1.3 To pay a non refundable deposit of R3 000 to the Westhill’s Business Estate Owner’s Association before the commencement of any construction, to cover any damage to the landscaping, road curbing and any other infrastructural elements provided by the developer. Any damage to infrastructure and landscaping in these areas by a Purchaser and/or his Building Contractor, or his tenant or employees shall be reinstated by the Westhill’s Business Estate Owner’s Association for the account of the Erf owner.

4.1.4 The Purchaser will maintain the exterior façade of his building, inclusive of boundary walls, to a standard acceptable to the Westhill’s Business Estate Owner’s Association.

5. DESIGN REVIEW

5.1 Establishment of a Design Committee

An initial Design Review Committee will be appointed by the developer.

On establishment of the Westhill’s Business Estate Owner’s Association this committee will be appointed by the Directors in terms of the constitution.
The Design Committee will consist of three or more members, including an Architect.

The committee may appoint additional technical advisors to assist in evaluating specific submissions. In special circumstances and at their discretion, the committee will be prepared to consider modifications or waivers of certain requirements laid down in this document.

5.2 Building Plan Review Procedures

5.2.1 Draft Building plan and site development plan proposals must be submitted to the Committee together with an initial submission fee of R1 000, for comment and approval before final design work is commenced. The Committee will endeavor to make comments and recommendations within 7 days of receiving a submission. The Committee reserves the right to request a meeting with the erf owner and his Architects to discuss the building design and site layout at this stage.

5.2.2 The then agreed final version of the detailed building plan and site development layout submission must be presented to the committee for approval before plans are submitted to the relevant local authority for building regulation approval.

5.2.3 The detailed design submission must include dimensional plans, sections, elevations at a scale of 1:100, and site plan of a scale of 1:500, indicating all external finishes and colours. Landscape details, site services, lighting, signage and the use to which the premises are to be put must also be included in the submission.

5.2.4 One set of paper prints of the plans which will include site layouts must be submitted to the Westhill's Business Estate Owner's Association before construction on site for their monitoring and record purposes. One set of "as-built" drawings must be submitted to the Westhill's Business Estate Owner's Association for their records on receipt of the Occupation Certificate from Council.

5.2.5 The Westhill's Business Estate Owner's Association reserves the right to monitor the progress of building work on site to ensure that the construction is being built in accordance with the approved design submission drawings, and to request meetings as required should significant or unacceptable changes be made to the building.
5.2.6 The Design Review Committee as soon as possible, will return to the Erf owner two complete sets of drawings and specifications stamped "approved" and signed by an authorized representative of the Westhill’s Business Estate Owner’s Association. These sets will become part of the agreement between the Erf owner and the Westhill’s Business Estate Owner’s Association. The costs of the copies will be for the erf owner’s account.

5.2.7 Subsequent additions and alterations to premises will be subject to the standard design review process and where premises are let, owners will be responsible for assuring compliance by tenants and the submission of “as built” drawings on the completion of the works.

6. **BUILDING AND ARCHITECTURAL GUIDELINES**

6.1 **Aesthetics**

6.1.1 Consideration to be given to the design theme created for the park, and of any then existing buildings to preserve architectural compatibility. Architectural innovation and flair is encouraged.

6.1.2 The different elements and textures of the design theme should be expressed on the façades and especially street frontages, and indicated on the drawings.

6.1.3 Preferred finishes:

* Face brick, semi-face brick or plaster & paint
* Composite panels (Alucabond, Burcalam, Vitrex, etc.)
* Marmaran stone chip or equal finish, textured plaster
* Colored sheeting, i.e. Chromadek or similar
* Roof tiles

6.1.4 Prohibited finishes:

* Stock bricks - unless approved by design committee
* Clinker bricks - unless approved by design committee
* Pressed steel roofing

* Visible Galvanized sheeting

6.2 Design

6.2.1 Foundations

All foundations should be constructed to the satisfaction of the appointed Project Civil Engineer, and not visible above the ground level. A face brick, semi-face brick or plaster and paint plinth is recommended.

6.2.2 Site Plans

Site Plans should give a clear indication of the positions and dimensions of the structures, their occupancies, materials to be used and their color scheme, including the landscaping, fence and pavement treatments.

6.2.3 Entrances

Entrances to individual stands should accommodate vehicle stacking to avoid possible traffic congestion. Public and visitors parking should be easily accessible. Proposed signage positions should be included and indicated on the drawings.

6.2.4 Fencing

Palisade or brick & palisade combination fencing are encouraged, no chain link or pre-cast concrete fencing allowed. Street frontages are to be well maintained. Refuse areas to be screened with landscaping or similar, preferably not directly visible from the street and within the building aesthetics. A right of way servitude of 2m as indicated must be given to the developer for security patrol purposes and to act as an extra fire buffer.

6.2.5 Lighting

Internal lighting should be installed and/or supervised by a specialist, and careful considerations to be given to the use of translucent sheeting to promote natural lighting.

External creative lighting of the structure at night is in order, provided it does not impede with traffic visibility.
6.3 **Required Specialists and Professionals**

6.3.1 **Profession Architect / Draughts person** - recommended  
Ebury Designs - Francois de Beer: 076-198-0944  
Monzeglio Cook - Giuseppe Monzeglio: 082-776-2311

* To be appointed by the purchaser and/or his Building contractor

* Responsible for design of erf.

* Copy of SACAP form for Council submission to be presented to the Westhill’s Business Estate Owner’s Association, with full contact details.

6.3.2 **Profession Civil Engineer** - recommended  
Consulting Civil Designs - Mark Adams: 082-210-4110

* To be appointed by the purchaser and/or his Building contractor.

* Responsible for all concrete work, i.e. foundations, floors, slabs, columns, composite walls, etc.

* Responsible for storm water disposal

* Responsible for earth works

* Responsible for super-structure

* Responsible for checking sub-contractors’ engineering

* Copy of engineer’s certificate for Council submission to be presented to the Westhill’s Business Estate Owner’s Association, with full contact details.

6.3.3 **Professional Electrical Engineer** - recommended  
Elektroplan Consulting Engineers - Stephen Carrack: 083-251-0657

* To be appointed by the purchaser and/or his Building contractor

* Responsible for all electrical installations
6.3.4 **Professional Fire Engineer** - recommended
Dynamic Fire Solutions - Richard Welsford: 083-417-9579

* To be appointed by the purchaser and/or his Building contractor
* Responsible for Rational Fire Plan, and approval thereof at the relevant Fire Department.
* Copy of Rational Fire Plan for Council submission to be presented to the Westhill’s Business Estate Owner’s Association, with full contact details.

6.3.5 **Professional Landscape Architect** - recommended
Toni Dyamond: 082-926-9295

* To be appointed by the purchaser and/or his Building contractor
* Responsible for Landscape Development Plan, and approval thereof at the relevant Council Department.
* Copy of Landscape Development Plan for Council submission to be presented to the Westhill’s Business Estate Owner’s Association, with full contact details.

6.4 **Recommended Specialists and Professionals**

6.4.1 **Professional Land Surveyor** - recommended

* To be appointed by the purchaser and/or his Building contractor
* Responsible for site survey, indicating contours and existing structures, trees, serves, etc.
* Responsible for consolidation and/or sub-division drawings and the approval thereof at the Surveyor General’s office, if necessary.
* Copy of new S.G. drawings and stand descriptions to be presented to the Westhill’s Business Estate Owner’s Association, with full contact details.
6.4.2 **Professional Town Planner** - recommended  
Velocity - Lydia Lewis: 083-409-1475

* To be appointed by the purchaser and/or his Building contractor

* Responsible re-zoning, consolidation, sub-division, restriction relaxations etc. of erven.

* Copy of new stand description to be presented to the Westhill’s Business Estate Owner’s Association, with full contact details.

6.4.3 **Professional Quantity Surveyor**

* To be appointed by the purchaser and/or his Building contractor.

* Responsible quantifying the construction program.

* Copy of construction program to be presented to the Westhill’s Business Estate Owner’s Association, with full contact details.

6.4.4 **Professional Artist Impressionist**

* To be appointed by the purchaser and/or his Building contractor.

* To present a perspective drawing of the proposed development.

* Copy of perspective drawing to be presented to the Westhill’s Business Estate Owner’s Association, with full contact details.

6.5 **Parking / Carports and outdoor furniture**

* Attractive shade structures will be acceptable.

* Innovative shade structures using pergolas to support climbing plants or “high tech” solutions are encouraged. An alternative would be to utilize the main structure (Office accommodation to create shaded parking below, for example).

EXCLUSIONS:
* Loading and offloading of goods must be accommodated on site. Visitors parking should be located on the roadside of the building and should be clearly demarcated.
6.6 **Storage and Service areas**

* The position of all site services must be identified before the commencement of design work. Information relating to the position of manholes and junction boxes to link into the site services infrastructure will be made available by the developer.

* Loading bays, refuse disposal, electrical sub-stations, emergency stand-by generators, and other on site services must be screened by walls, earth banking and dense planting. They should not be visible from entrance roads, the main road system or any public open space.

6.7 **Building lines, bulk, height and parking ratios**

The property is subject to the town planning regulations as contained in the applicable Conditions of Establishment for the Township.

7. **SIGNAGE GUIDELINES**

It is intended that all signage should be discreet and sympathetic to the Estate’s appeal without detracting from its functionality.

7.1 **Street Signage and Number Detail**

* In order to unify and simplify street numbers the Westhill’s Business Estate Owner’s Association requires a standard detail to be used to which the individual developer may add their own corporate identity. Detail to be supplied by the Westhill’s Business Estate Owner’s Association.

7.2 **Marketing and Third Party signage**

No Third party signboards other than those provided by the Westhill’s Business Estate Owner’s Association will be permitted within the Estate. Sites and buildings sold may have one sign with the words, “Property Sold by...” erected at the expense of the agent within the recommended guidelines.